



## **Building consensus on how to address the analysis of ecosystem services in the life cycle assessment (LCA) framework**

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## BOOK OF ABSTRACT

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### I. SESSION DESCRIPTION

**ID: T11**

Telecoupling through global and interregional flows of ecosystem services

**Hosts:**

	Title	Name	Organisation
<b>Host:</b>	Mr.	Matthias Schröter	Helmholtz Centre for Environmental Research – UFZ
<b>Co-host:</b>		Nynke Schulp, Thomas Koellner	

**Abstract:**

Many studies focused on mapping, modelling and valuing a set of ecosystem services for a specific region or nation. Quite frequently those activities choose the political border as their system boundaries assuming that the regions are closed. However, these regions are typically open with respect to flows of matter, energy and information, and hence a multitude of ecosystem services. Regional and national studies often neglect the dependence on "overseas" ecosystem services. However, interregional flows of ecosystem services can cause telecouplings between regions. Such ecosystem services flows may cause detrimental effects in distant source regions and hence cause conservation problems. Some of the interactions between regions are directly embedded in trade flows, others cascade more indirectly through the socio-economic system, yet others are transferred through different types of environmental flows. Ultimately, policies aiming at enhancing ecosystem services in one region should not lead to ecosystem damage elsewhere. To cover this field a new ESP thematic working group "Global Ecosystem Service Flows" was installed during the World Conference in 2015 in South Africa. This group is hosting this session. Presentations address open research questions related to (i) quantitative assessments of interregional ecosystem service flows and telecouplings, incl. (spatial) modelling, (ii) their evaluation in terms of benefits and damages, (iii) consequences for interregional conservation of biodiversity and management of ecosystem services.



### Goals and objectives of the session:

This session aims at exchange on methods and applications how to complement regional assessments of ecosystem services with a global assessment of ecosystem flows to and from a specific region. This opens the possibility to present work relevant for ecosystem services on material flow analysis of trade, embodied water and land, environmental footprints as well as life cycle assessment.

### Related to ESP Working Group/National Network:

[Thematic Working Groups: T11 – Global ES flows](#)

## II. SESSION PROGRAM (T11)

**Date of session:** Thursday, 18 October 2018

**Time of session:** 08:45 – 10:15

### Timetable speakers

Time	First name	Surname	Organization	Title of presentation
08:45–09:00	Carina	Mueller	Stockholm Environment Institute, University of York	Natural Capital indicators for assessing the impacts of globalised food supply chains – A systematic literature review
09:00–09:15	Francis	Turkelboom	Research Institute of Nature and Forest (INBO)	Telecoupling the Tomato Trade: What consumers do not know about the tomato on their plate.
09:15–09:30	Janina	Kleemann	Martin–Luther University Halle–Wittenberg	Global interconnections in ecosystem services provision and use – the case of Germany
09:30–09:45	Matthias	Schröter	UFZ – Helmholtz Centre for	Interregional flows of cultural ecosystem services: distant provenance of and threats to



Time	First name	Surname	Organization	Title of presentation
			Environmental Research	service-providing species
09:45–10:00	Benedetto	Rugani	Luxembourg Institute of Science and Technology (LIST)	Building consensus on how to address the analysis of ecosystem services in the life cycle assessment (LCA) framework
10:00–10:15	NA	NA	ESP TWG 11	Joint discussion (incl. current work of the ES working group on Global ES flows)

### III. ABSTRACTS

*The abstracts appear in alphabetic order based on the last name of the first author. The first author is the presenting author unless indicated otherwise.*

#### 1. Type of submission: **Abstract**

T. Thematic Working Group sessions: T11 [Telecoupling through global and interregional flows of ecosystem services](#)

#### Global interconnections in ecosystem services provision and use – the case of Germany

*First author:* Janina Kleemann

*Other author(s):* Matthias Schröter, Kenneth Bagstad, Christian Kuhlicke, Thomas Kastner, Dor Fridman, Nynke Schulp, Sarah Wolff, Thomas Koellner, Sebastian Arnhold, Laura Lopez-Hoffman, Jianguo Liu, Meidad Kissinger, Berta Martin-Lopez, Carlos Antonio Guerra, Alexandra Marques, Javier Martínez-López, Aletta Bonn

*Affiliation, Country:* Martin-Luther University Halle-Wittenberg, Institute for Geosciences and Geography, Dept. Sustainable Landscape Development, Germany

In a globalized world, ecosystem services are directly and indirectly used by beneficiaries in areas far from the ecosystems that initially generate ecosystem services. Active or passive ecosystem service flows can occur through the flow of goods, species, natural elements (i.e., air and water), or information. The assessment of these ecosystem service flows is needed to detect dependencies between different countries and estimate the impacts of globalization on distant locations. Such approaches also have potential to highlight impacts and





dependencies between the global North and South. Based on a tiered modelling approach that has been developed to address four types of international ecosystem service flows, we analyzed Germany's interconnection with other countries through: a) cocoa import as luxury good (biophysical flow of traded goods), b) migratory birds providing pest control (flow mediated by species through migration and dispersal), c) floodplain ecosystems providing flood control (passive biophysical flow) and d) China's panda loan to the Berlin Zoo (information flow). Apart from using different methodological approaches and metrics, differences also exist in data representation and the resolution of results. The analysis also demonstrates the importance of holistic ecosystem service assessments that extend beyond the boundaries of nations, and the value of ES quantification to raise awareness of global ecosystem service dependencies.

**Keywords:** ecosystem services, assessment, interregional flows, dependencies

2. *Type of submission:* **Abstract**

**T. Thematic Working Group sessions:** T11 [Telecoupling through global and interregional flows of ecosystem services](#)

**Natural Capital indicators for assessing the impacts of globalised food supply chains – A systematic literature review**

*First author:* Carina Miriam Mueller

*Other author(s):* Simon Croft, Jonathan Green, Emilie Hobbs, Chris West

*Affiliation, Country:* Stockholm Environment Institute, Sweden, University of York, GB, United Kingdom

Globalisation has created highly complex supply chains where the biggest risks and impacts are increasingly far-removed from consumption, and thus challenging to understand and manage. Governments and businesses have realised the importance of 'Natural Capital' and, in particular, the provisioning role of ecosystem services in production-to-consumption systems, as well as the risks that these systems pose to the services that underpin human wellbeing – for example through pledges to eliminate deforestation from agricultural supply chains. However, methods to understand the consequences of supply chain decisions on global ecosystem services, or monitor progress towards targets, are only now emerging. To understand dependencies of natural resource consumption, a global approach with several indicators quantifying crucial ecosystem services and trade-offs is needed. Recent advances in the transparency and traceability of supply chains (fostered by the integration of international material trade flow modelling, life cycle assessment, ecological economics and



spatial modelling), along with satellite-derived land cover maps, allow accounting for the spatial heterogeneity in ecosystem characteristics in producing countries and provide us with a possibility to link production system impacts and risks to consumption choices. Based on a systematic review of the scientific literature, this study critically evaluates (1) the temporal and spatial resolution for ecologically meaningful assessments of ecosystem services (2) the robustness and uncertainty of available methodologies, (3) the relevance and applicability of existing ecosystem service indicators to the decision-making context of globally sourced agricultural products and (4) the feasibility of monitoring progress towards targets of individual actors. It further aims to classify the indicators within the DPSIR (Driver Pressure State Impact Response) framework. Remaining knowledge, data and methodological gaps to support decision-making towards policy and business sustainability goals will be identified.

**Keywords:** Telecoupling, Decision making, Land Footprint, Ecosystem services, Sustainability

3. *Type of submission:* **Abstract**

**T. Thematic Working Group sessions:** T1 1 [Telecoupling through global and interregional flows of ecosystem services](#)

**Building consensus on how to address the analysis of ecosystem services in the life cycle assessment (LCA) framework**

*First author:* Benedetto Rugani

*Other author(s):* Danielle Maia de Souza, Xinyu Liu, Bhavik Bakshi, Bo Weidema, Jane Bare, Blane Grann, Ana Laura Raymundo Pavan, Alexis Laurent, Francesca Verones

*Affiliation, Country:* Luxembourg Institute of Science and Technology (LIST), Luxembourg

The assessment of ecosystem services (ES) is fragmentally covered by existing environmental decision support tools that aim to inform on the potential environmental impacts of supply chains and their products, such as the well-known life cycle assessment (LCA) method. Under the frame of the UNEP-SETAC Life Cycle Initiative flagship project on life cycle impact assessment (LCIA) indicators, a dedicated subtask force was constituted to consolidate the evaluation of ES in LCA. As an outcome of the activities promoted by this subtask force, the present contribution aims to illustrate the progress towards consensus building in the LCA domain concerning the assessment of human related impacts on ecosystems and their capacity to provide services for human well-being. First, the study proposes a general framework for integrating ES approaches into the cause-effect chain used in LCIA, designed according to a cascade model for ES. Then, an application of the proposed LCIA framework is shown through a case study on rice production modelled for three different locations in the



world (i.e. USA, China, India). The cascade model, used here to depict LCIA cause–effect chains, is formulated according to sound scientific arguments grounded on the ES literature, which relate the effect of changes on ecosystems due to human impacts (e.g. land use changes, eutrophication, freshwater depletion, ...) with the increase or decrease in the quality and/or quantity of supplied ES. These impacts and damages are reflected into specific areas of protection for natural resources and ecosystem quality, and eventually back on the technosphere system in the form of costs or benefits associated with the functional unit (produced rice in this specific case). Based on this experience, a set of recommendations is provided on how to address current gaps in the analysis of ES within the LCA framework.

**Keywords:** LCA, cascade model, cause–effect

4. *Type of submission:* **Abstract**

**T. Thematic Working Group sessions:** T11 [Telecoupling through global and interregional flows of ecosystem services](#)

**Interregional flows of cultural ecosystem services: distant provenance of and threats to service–providing species**

*First author:* Matthias Schröter

*Other author(s):* Roland Kraemer, Roy P. Remme, Alexander P.E. van Oudenhoven

*Affiliation, Country:* UFZ – Helmholtz Centre for Environmental Research, Germany

Ecosystem service (ES) assessments often fall short of considering flows between distant regions. Large knowledge gaps remain for interregional flows of cultural ES, which comprise non–material contributions of ecosystems to human well–being. We spatially delineated and analysed the sending regions on a global scale for interregional flows of three cultural ES to two receiving regions, Germany and the Netherlands. The selected ES are aesthetic appreciation of species, existence and bequest values held for species, and birdwatching. We compared the most important sending regions (hotspots) for both countries in terms of location (biomes covered), equity implications due to potential conservation burdens (gross domestic product per capita), threat (human footprint) and protection status (protected areas). The proportion of species with habitats distant from the receiving region was highest for birdwatching (Germany: 58.6%, Netherlands: 59.4%), followed by existence and bequest values (Germany: 49.3%, Netherlands: 57.1%), and aesthetic appreciation (Germany: 26.7%, Netherlands: 20.0%). We found distinct spatial patterns for sending regions for Germany and the Netherlands for all three services. Hotspots for both German and Dutch sending regions were predominantly situated in tropical and subtropical grasslands, savannas and





shrublands. Hotspots for existence and bequest and birdwatching for both countries were significantly more threatened than the global mean, and both were considerably poorer than the global mean. Protection levels of sending region hotspots for flows to Germany were slightly higher than the global protection level (14.9%) for existence and bequest (20.0%) and birdwatching (15.5%), while for Dutch sending region hotspots protection levels (13.4%, and 12.6% respectively) were slightly lower than the global level. We discuss issues of equity related to conservation burdens in order to sustain the provision of interregional ES flows. We propose the further development of this approach into a footprint for cultural ES.

**Keywords:** ecosystem service flows, telecoupling, service– providing species, biodiversity, cultural ecosystem services

5. *Type of submission:* **Abstract**

**T. Thematic Working Group sessions:** T11 [Telecoupling through global and interregional flows of ecosystem services](#)

**Telecoupling the Tomato Trade: What consumers do not know about the tomato on their plate.**

*First author:* Maria-Jose Ibarrola-Rivas, Francis Turkelboom

*Other author(s):* Antonio Castro, Thomas Kastner, Sanderine Nonhebel

*Affiliation, Country:* Instituto de Geografía, UNAM, Mexico, Research Institute of Nature and Forest (INBO), Belgium

Food imports and urbanization have resulted in a strong disconnect between food consumption and production. Food production has local environmental, social and economic impacts, but they depend on the type of production system (e.g., traditional versus intensive), and the local contexts where the food is produced. As these impacts are usually not known to the consumer, choice of imported food results in unknown social and ecological impacts in the exporting countries. In this paper, the international tomato trade is used as an example to explore the impacts/relationships between consumers and food producers. We chose the tomato trade because: 1. It is one of the largest crops in the global market (in volume), 2. the global trade of tomato has strongly increased during the last decades, and 3. it is an example which indicate dietary changes towards an affluent consumption pattern. The telecoupling framework is used to analyze the trade-offs between environmental, social and economic impacts when consuming tomatoes. Germany serves as an example for importing countries (receiving system), while the Netherlands and Spain are examples of major exporting countries (sending systems). We then compare local production





impacts (environmental, social and economic) between exporting countries as a result of the respective production systems and local context. Our results show that even though there are similarities in the impacts associated with tomato production systems (such as intensive production for export, cheap labour from immigrants, intensive use of inputs), differences in local impacts are large due to the local biophysical, economic and political contexts (e.g. water depletion vs. GHG emissions; wellbeing of the workers). This analysis provides methodological and knowledge insights for understanding the linkages between consumption and the environmental, social and economic impacts in remote production areas of a global traded agricultural commodity.

**Keywords:** Telecoupling framework, tomato trade, greenhouses production systems, local social and environmental impacts, ecosystem services